Overview of EPA's Arsenic Treatment Research

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Research and Development at EPA

- 2,000 employees
- $700 million budget
- $100 million extramural research grant program
- 13 lab or research facilities across the U.S.
- Credible, relevant and timely research results and technical support that inform EPA policy decisions

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Making decisions with sound science requires..

- Relevant, high quality, cutting-edge research in human health, ecology, pollution control and prevention, and socio-economics
- Proper characterization of scientific findings
- Appropriate use of science in the decision process

Research and development contribute uniquely..

- Health and ecological research, as well as research in pollution prevention and new technology
- In-house research and an external grants program
- Problem-driven and core research

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High Priority Research Areas

- Human Health
- Particulate Matter
- Drinking Water
- Clean Water
- Global Change
- Endocrine Disruptors
- Ecological Risk
- Pollution Prevention
- Homeland Security

Presentation

- Overview EPA's Arsenic Rule Implementation Research Program
- Background
- Goals
- Detail Demonstrations

Arsenic Rule Implementation Research Program

Background

- October 31, 2001, Administrator announced lowering of arsenic drinking water standard to 10 ppb.
- Also announced that “EPA plans to provide $20 million over next two years for research and development of more cost-effective technologies/training/technical assistance.”
- Focused on small systems (10,000 population or less)

FY03 Congressional Appropriation

- $5 million for small system arsenic removal research.
- Strongly encourage use of funds for demonstrations of implementation of low-cost treatment technology.
- Report to Congress required August 15, 2003.

Arsenic Rule Implementation Research Program

Objectives

(1) Identify and evaluate new cost-effective technologies

(2) Demonstrate/verify performance of existing and new commercially available technologies

(3) Provide technical guidance to small communities, regulators and consulting firms on selection and design of cost-effective systems to meet the arsenic MCL

Major Elements

- Small Business Innovation Research/Science to Achieve Results
- Treatment Technology Demonstrations
- Environmental Technology Verifications
- Enhanced base research program
- Training and technical assistance

Major Elements

- Small Business Innovation Research/Science to Achieve Results

Small Business Innovation Research

-Promote and evaluate new and emerging treatment technologies.

-Through ORD's Small Business Innovation Research Program issued a solicitation early in 2002 requesting new arsenic treatment technologies from small business community.

-Awards are for bench level studies – Phase I/II awards

-Fifty proposals received for Phase I

SBIR Emerging Technologies

Filtration

Sorbents (24)

Biological

Oxidation

Co-precipitation

Other

Monitoring

Phase I SBIR Technologies Selected

Materials Modification, Inc. - Nanocomposite-based filter for Arsenic Removal

HydroTech Engineering - Limestone-based Material for Arsenic Removal

Microporous Oxides Science and Technology, **LLC** -Arsenic Removal using Photoactive Adsorbent

Argonide Corporation - Nano Alumina Arsenic Filter

VEETech, P.C. - Arsenic Removal Using a Novel Hybrid Sorbent

Daniel B. Stephens & Assoc., Inc. - Subsurface Treatment for Arsenic Removal

HydroPure Technologies, LLC - Arsenic Treatment Using SAMMS, High Capacity Selective Sorbent

ADA Technologies, Inc. -Arsenic Removal System for Residential and Point of Use Applications

SBIR Phase II Awards

-HydroTech Engineering - Limestone-based Material for Arsenic Removal

-VEETech, P.C. - Arsenic Removal Using a Novel Hybrid Sorbent

-ADA Technologies, Inc. -Arsenic Removal System for Residential and Point of Use Applications

New Technologies for the Environment

-A Novel Ion Exchange Process for Selective Removal of As(V) and Enhanced Stability of Process Residuals

-A Novel Adsorption Technology for Small-Scale Treatment of Arsenic

-Modified Natural Zeolite as a Selective Sorbent for Simultaneous Removal of Arsenites and Arsenates

Major Elements

- Treatment Technology Demonstrations

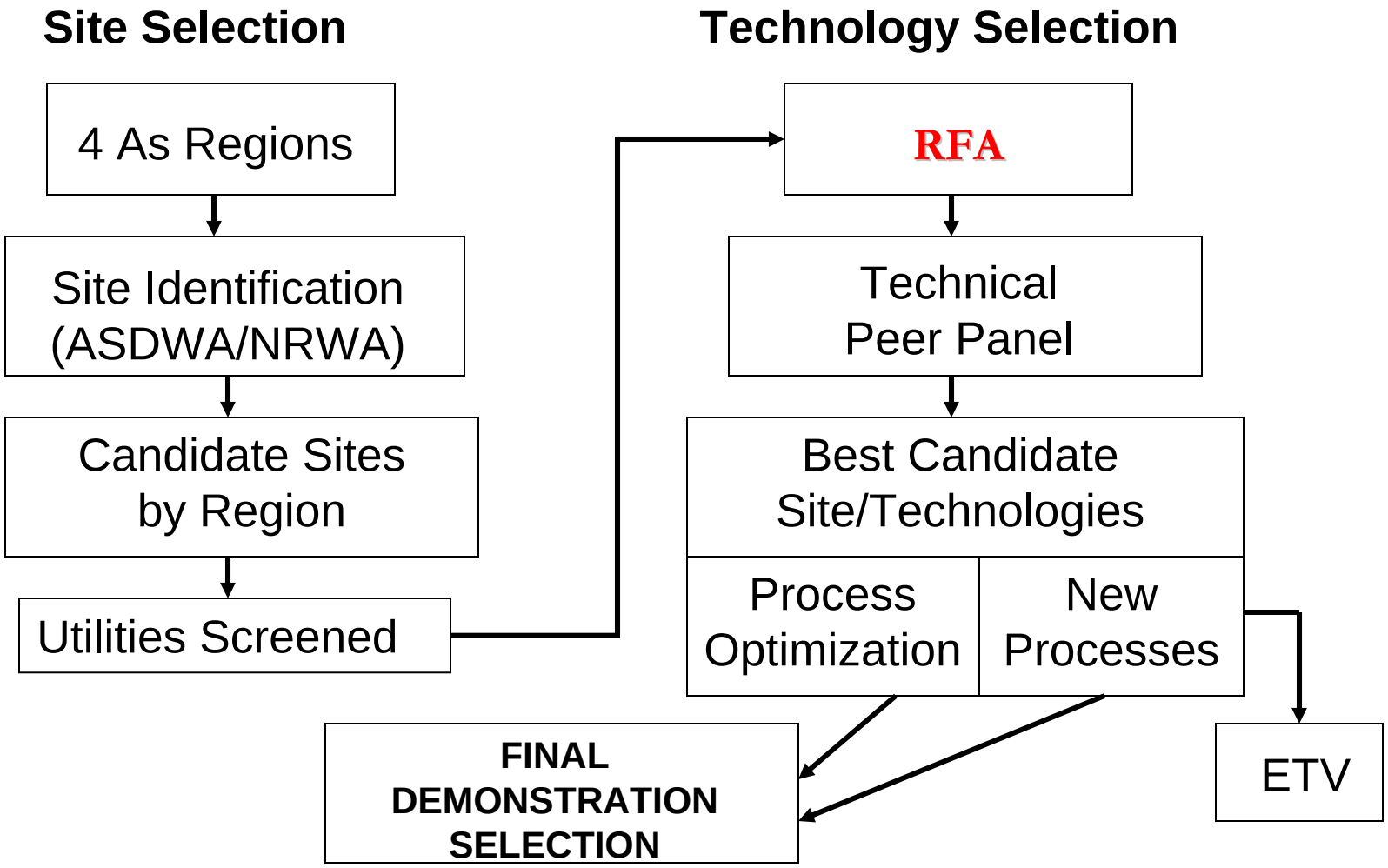
Demonstrations

- $12 million targeted to this effort
- Full-scale, long-term (1 year) in scope
- Focused on commercially ready technologies or engineering approaches
- Fill in scientific gaps

Goals of Demonstrations

- Determine/document the construction costs/operational costs of the new system or the modifications of existing systems to achieve compliance.
- Determine/document performance of the new process or process modifications of existing treatment for 1 year in achieving compliance.
- Determine the operational and maintenance requirements of treatment system.
- Characterize the residuals produced by the process; quantity and chemical characteristics.
- Evaluate effectiveness of residuals disposal process and/or the impact of residuals on existing disposal process.

Demonstrations



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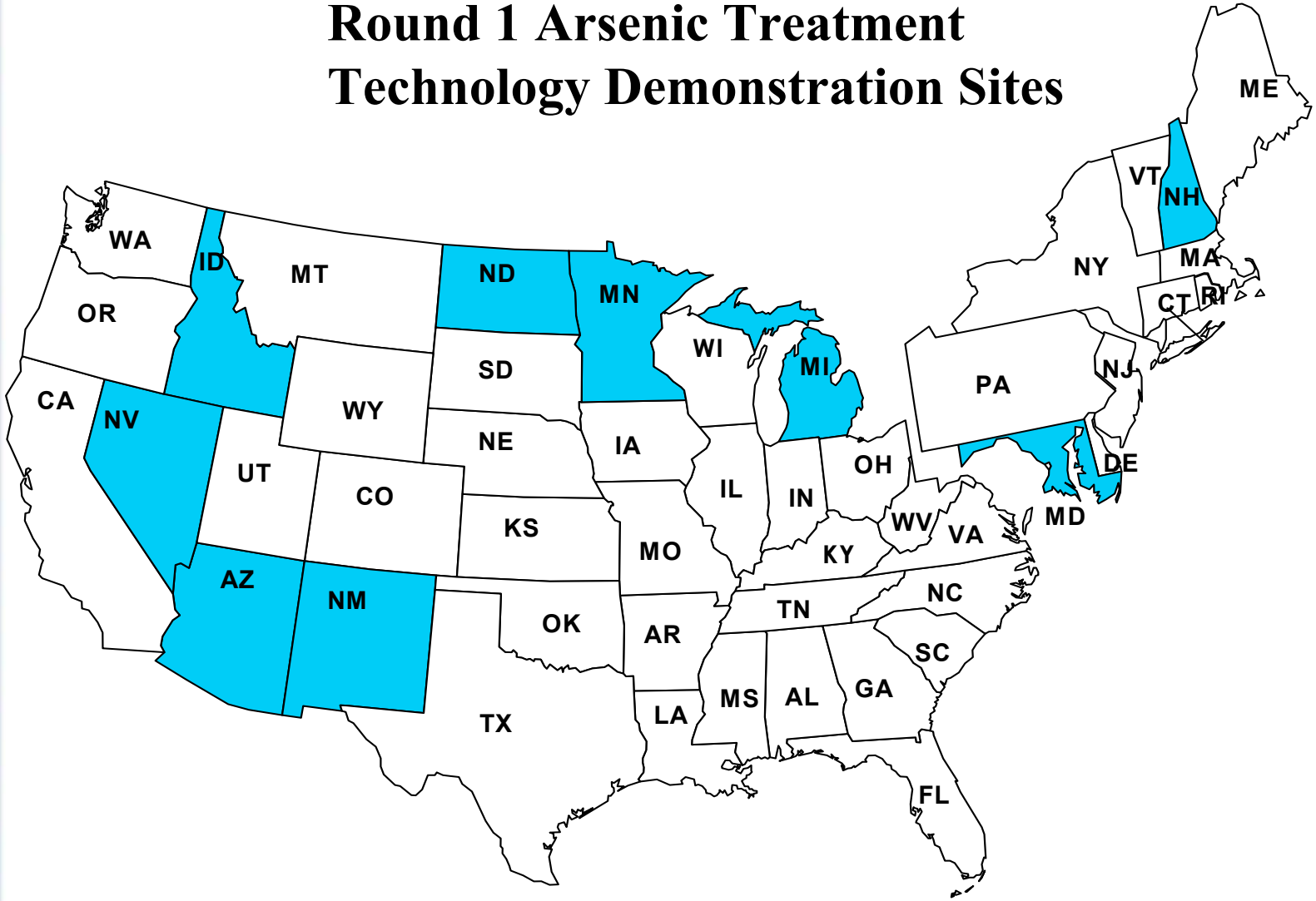
Round 1 Arsenic Treatment Technology Demonstration Sites



Round 1 Arsenic Treatment Technology Demonstration Sites

Site	Technology to be Demonstrated
Rimrock, AZ	AdEdge Iron Media
Valley Vista, AZ	Kinetico Activated Alumina
City of Fruitland, Fruitland, ID	Kinetico Ion Exchange
Queen Anne's Co, Stevensville, MD	Severn Trent Iron Media
Brown City, Brown City, MI	Severn Trent Iron Media
Town of Climax, Climax, MI	Kinetico Oxid/CoPrecip/Filtration
Lidgerwood, ND	Kinetico Modified Treatment
Holiday Acres, Allenstown, NH	ADI Iron Adsorption /Regeneration
Rollinsford, NH	AdEdge Iron Media
Anthony, NM	Severn Trent Iron Media
Nambe Pueblo, NM	AdEdge Iron Media
South Truckee Meadows, Reno, NV	US Filter Iron Media

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Round 2 Solicitation Information

Title: Treatment Technologies for Arsenic Removal for Small Drinking Water Systems FY2004

Opened – September 24, 2003

Closes - January 5, 2004

Round 2 Demonstration Sites

East	Central MW	MW	Far West
Felton, DL	Sauk Centre, MN	Breaux Bridge, LA	Susanville, CA
N. Springfield, RI	Sabin, MN*	Arnaudville, LA	Lake Isabella, CA
Goffstown, NH	Stewart, MN	Stromsburg, NE	Klamath Falls, OR
Dummerston, VT	Springfield, OH	Lyman, NE	Taos, NM
Wales, ME	Grove City, OH	Wellman, TX*	Homedale, ID
	Newark, OH	Alvin, TX	Okanogand, WA
	Greenville, WI*	Bruni, TX	Three Forks, MT
	Sandusky, MI		Techachapi, CA*
	Pentwater, MI		Tohono O'odham, AZ (Sells)*
	Delavan, WI		Vale, OR
(5)	(10)	(7)	(10)

* Site selected, but not funded in Round 1

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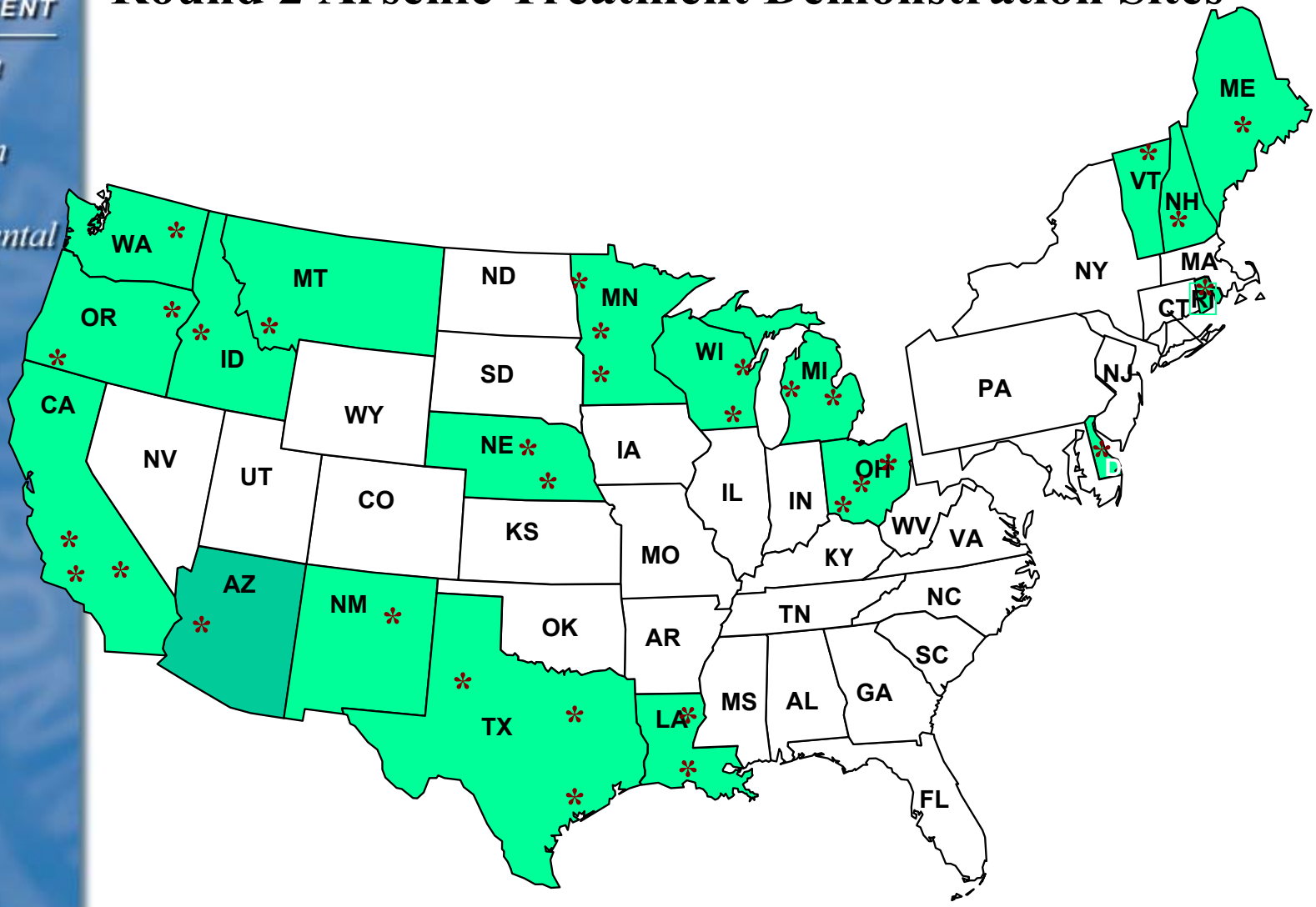
Round 2 Arsenic Treatment Demonstration Sites



Changes from Round 1

- Includes non-transient non-community water systems
- Allows for demonstration of Point-of-Use/Point-of-Entry Approaches
- Multi-contaminant treatment

Multi-Contaminant Sites

- **Lake Isabella, CA - Arsenic/Uranium**
- **Lyman, NE – Arsenic/Uranium**
- **Three Forks, MT – Arsenic/Nitrate**
- **Homedale, ID – Arsenic/Nitrate**
- **North Springfield, RI – Arsenic/Gross Alpha**

Major Elements

- Environmental Technology Verifications

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Environmental Technology Verification Program

- Program verifies the performance of treatment technologies according to established test protocols
- Short term tests, commercial ready technologies
- NSF is EPA cooperator for drinking water treatment technologies

ETV Arsenic Verifications

- Hydrauntics – Reverse Osmosis Membrane Element Module
- Kinetico, Inc – Macrolite Coagulation and Filtration System
- Koch Membrane Systems – Reverse Osmosis Membrane Module
- Watermark Technologies, Coagulation and Filtration Systems

Environmental Technology Verification Program

- Demonstrations of adsorptive media technologies this year
- Cooperative treatment study with Pennsylvania DEP

Major Elements

- Enhanced base research program

Enhanced Base Research Program

- Arsenic speciation
- Treatment Optimization Studies
- Engineering Design Manuals/Cost Program
- Residuals Management
- Distribution recontamination

Speciation and Preservation of Arsenic in Drinking Water

- Effective treatment decision making can be enhanced by determining the distribution of As (III) and As (V).
- Method developed using EDTA to preserve As species in iron rich waters.

New Indicator for Predicting High Arsenic in Groundwater

-Technique known as O-18 sulfate isotope analysis

-Based on fractionation theory during oxidation

-Requires only 1 sample/analysis from only 1 well in area of interest within watershed

-Even if As levels are low/non-detected, will indicate the risk of a future elevated hit

-Tested successfully in Goose River watershed, Maine (see example figure)

-May be dependent on local hydrogeology (being tested elsewhere under different hydrogeologic setting)

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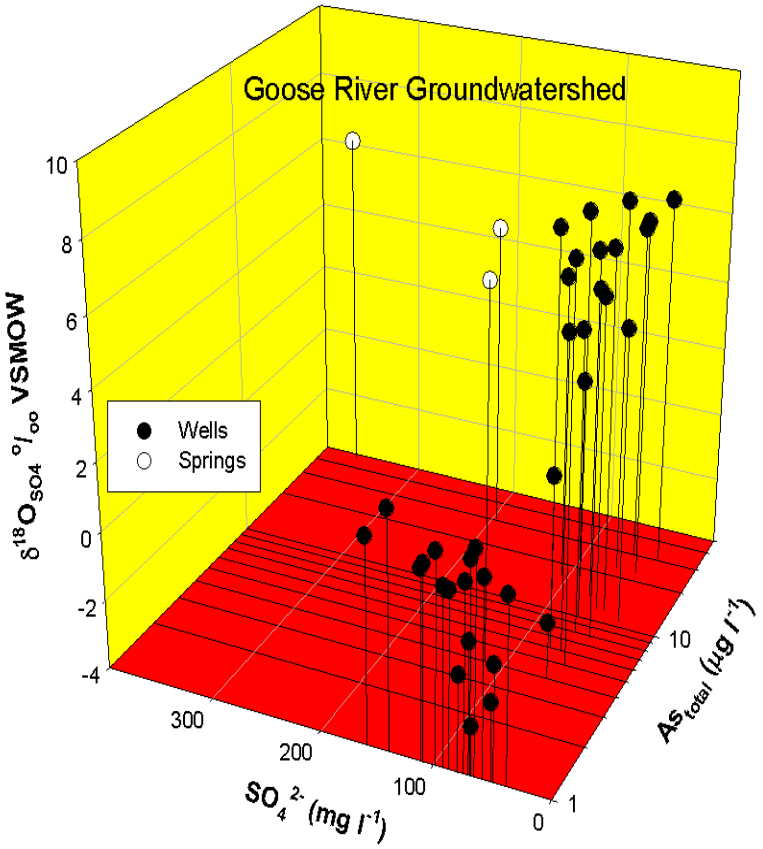
Oxidation Discriminator



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Major Elements

- Training and technical assistance

Training and Technical Assistance

- Working with the Office of Ground Water and Drinking Water
- University of Nebraska funded to investigate well pumping approach for arsenic control
- Supported State of Arizona in preparation of arsenic master plan

Resource Manuals Completed

Design Manual: Removal of Arsenic from Drinking Water by Adsorptive Media

Arsenic Removal from Drinking Water by Coagulation/Filtration and Lime Softening Plants

Arsenic Removal from Drinking Water by Iron Removal Plants

Arsenic Removal from Drinking Water by Ion Exchange and Activated Alumina Plants

Treatment of Arsenic Residuals from Drinking Water Removal Processes

Oxidation of As(III) by Aeration and Storage

Laboratory Study on the Oxidation of As III to As

Regulations on the Disposal of Arsenic Residuals from Drinking Water Treatment Plants

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Further Information

Website

www.epa.gov/ORD/NRMRL/arsenic/

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Thank you